Defining dangerous: Report of the annex 1 workshop on article 2 of the climate convention. (HOT WD1)

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Defining Dangerous: Report of the Annex 1 workshop on Article 2 of the Climate Convention

HOT WD1

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Summary

This report contains the results of a workshop held 2-3 June 2003 in Amsterdam as part of the first phase of the project entitled "Helping Operationalise article Two (HOT): A science-based policy dialogue on fair and effective ways to avoid dangerous interference with the climate system and implications for Post-Kyoto policies". The HOT project concerns a science-based policy dialogue on fair and effective ways to avoid dangerous interference with the climate system and implications for Post-Kyoto policies. The workshop, aimed at policy makers and stakeholders from industrialised countries (Annex I) only, was part of a series of regional scooping meetings in Asia, Latin America, Africa and Europe during the first preparatory phase of the HOT project (January –September 2003). The purpose of this meeting was to discuss and elaborate on the content of Article 2 of the Climate Change Convention and collect ideas within Annex I regarding ways to operationalise Article 2 and the design of a follow up of the dialogue on the global level. The workshop revealed differences in perceptions but also a great interest in continuing the dialogue in a second phase of the HOT project.

1. Introduction

This report contains the results of a workshop held 2-3 June 2003 in Amsterdam as part of the first phase of the programme entitled "Helping Operationalise article Two (HOT): A science-based policy dialogue on fair and effective ways to avoid dangerous interference with the climate system and implications for Post-Kyoto policies". The HOT project concerns a science-based policy dialogue on fair and effective ways to avoid dangerous interference with the climate system and implications for Post-Kyoto policies. The workshop, aimed at policy makers and stakeholders from industrialised countries (Annex I) only, was part of a series of regional scooping meetings in Asia, Latin America, Africa and Europe during the first preparatory phase of the HOT project (January – September 2003). The purpose of this meeting was to discuss and elaborate on the content of Article 2 of the Climate Change Convention and collect ideas within Annex I regarding ways to operationalise Article 2 and the design of a follow up of the dialogue on the global level.

1.1 Background of the workshop: The HOT project and its objectives

In 1992, the United Nations Framework Convention on Climate Changes (UNFCCC) was signed. The ultimate objective of the UNFCCC is formulated in Article 2:

"(...)to achieve, in accordance with the relevant provisions of the Convention, the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

After the entering into force of the UNFCCC, the policy discussions soon focussed on the need for short-term actions. This resulted in 1997 in the adoption of the Kyoto Protocol. With the Protocol global society has made a first, but small step towards the attainment of the ultimate goal of the Climate Convention. In order to attain a stabilisation of atmospheric concentrations of greenhouse gases, (GHGs), emissions will have to be strongly reduced in the long term. The level at which the concentrations of GHGs are eventually stabilised determines the overall level of global climate change. At the same time, the level of climate change and the severity of its impacts are highly uncertain, particularly at the regional level. Moreover, defining what constitutes a 'dangerous' level of climate change inevitably involves value-loaded choices related to acceptable risks of climate change and of climate change policies that cannot be resolved by scientific inquiry only. Therefore there is a need for dialogue amongst policymakers and stakeholders about acceptable and unacceptable climate change impacts, about fair ways of dealing with the unequal distribution of impacts, and about options for a fair distribution of emission control and adaptation costs.

According to the Kyoto Protocol, the negotiations on new commitments for the second commitment period (2013-2017) should start by 2005. This again will raise the question what the overall level of stringency of mitigation commitments should be. Given the

large inertia in the climate system near-term action should be related to long-term climate policy goals in order to avoid closing off some long-term policy options (Berk et al, 2001).

For these reasons the HOT project was initiated. The purpose of the HOT project is to help better articulate and operationalise the ultimate objective of the Climate Change Convention as stated in Article 2 in specific terms on the basis of a science-based policy dialogue, providing support to future policy debates on the need for new near action.

The aims of the HOT project are to:

- facilitate a scientifically well-informed dialogue amongst climate change policy stakeholders to help define what would constitute "dangerous interference with the climate system" as covered by Article 2 of the FCCC;
- improve insights in differences of perspectives for building consensus towards policy action;
- provide insights into options for fair and effective post-Kyoto global climate change regimes for mitigation, impacts and adaptation, and
- link the debate on medium-term (post 2012) climate policy targets to long-term perspectives on effective and fair climate change impact control and sustainable development.

As such a global policy dialogue is a complex, time-intensive and costly process, it was felt that a preparatory phase would be needed. For this phase funding was obtained from the Dutch Ministry of Environment. For the actual dialogue more funding options would be explored. This would require a well-elaborated project plan based on insights gained from the preparatory phase. The objectives of this first phase of the project therefore were:

- to identify the possible participants in such a dialogue and to secure their commitment to the project;
- to come to a common problem definition, dialogue agenda and methodology that will allow for effective and fair participation of all participants in the dialogue;
- to prepare a detailed project proposal for the dialogue phase, and;
- to generate support amongst the policy and funding community for such a dialogue.

As part of the preparatory phase a series of dialogues would be organised in different regions of the world on Article 2. These workshops would be organised by the regional project partners: for Africa ENDA-Tiers Monde in Senegal, for Asia the The Energy and Resources Institute in New Delhi and for Latin America COPPE in Brazil. In preparing for the dialogue, a first round of questionnaires was sent out to stakeholders in the region to gather their perspectives on the issue. Next participants would be selected and asked to elaborate their personal views on the Article. These views together with the results of the questionnaires would be used as input for regional workshops.

The outcomes of the regional workshops will be integrated in the preparation for a global dialogue. Participants in the global dialogue will then return to their regions to discuss the issues at regional level. This is envisaged to lead to a new set of regional dialogues, followed by a global dialogue and one more round of regional dialogues.

1.2 Objectives and design of the HOT workshop

The objectives of the Annex 1 workshop were to:

- make a start with exchanging views on Art. 2 in order to increase mutual understanding of different perspectives;
- make a start with defining criteria for assessing dangerous levels of climate change impacts, and;
- get advice on the contents and set up a global dialogue on Art. 2 in the second phase of the HOT project.

The workshop was set up as a one-day "around the clock" workshop, starting in the late afternoon and ending around the same time the next day (see for the programme Annex I). Regarding its design, the workshop reserved much room for input from participants to enhance their involvement. For this reason, after some introductions by the project team, the programme started with the presentation by two participants of their views on Article 2 and also included smaller outbreak groups the next day for more intensive interactions. The design also gave priority to the views and ideas of the participants instead of to the input of scientists. Their input was scheduled for the next day.

With respect to the input of scientific information a limited number of scientists were invited, covering various fields of expertise relevant for the elaboration of Article 2, including physics, ecology, economics, social and ethical issues, and development issues. Most experts were given short slots for presenting their views, in addition to an overall introduction by the Tyndall Centre on the contribution of science to the elaboration of Article 2. Moreover, the scientists normally participated in the discussions.

While the HOT project itself addresses a much wider set of issues - including costs and opportunities for mitigation and adaptation and the implications of long-term climate change targets for near term-policy making - the focus of the preparatory Annex I workshop was mainly on general perceptions of Article 2 and on views about appropriate indicators for defining dangerous climatic change. This choice was made to limit the complexity of the discussions and because the other issues were considered to be part of next steps in the eventual dialogue. It also allowed the participants to spend considerable time in breakout groups to discuss possible indicators for defining dangerous climate change.

At the end of the workshop, time was reserved for discussing ideas for a follow up of the workshop during the second phase of the HOT project.

1.3 Introduction to the workshop (1): some theoretical perspectives [1]

The meeting began with an introduction by Joyeeta Gupta. She began with the frog metaphor. A frog put into boiling water will jump out. A frog put in water which is then put to boil might get used to the gradual heating process, may become numbed by the process and may not be able to jump out in time. The global population is in the situation of the frog in the latter situation. She submitted further that in the global negotiating

[1] By Joyeeta Gupta, IVM.

process, it is often very difficult for countries negotiating their national interests to actually reach problem solving. In fact, realists predict that problem solving will be impossible. Institutionalists however see that there may be some space for problem solving in such complex issues by bypassing the truly difficult issues and by trying to focus on those issues where simple solutions present themselves. This is why, she argued, there is a climate convention, but no clear articulation of its long-term goals. In fact, negotiation is not necessarily the appropriate tool to reach a better understanding of the issues involved in climate change. Nor can research per se develop an adequate approach. The only way to deal with an issue where the science is so uncertain, the problem asymmetrical in its effects and where the values differ from country to country is to have a global dialogue on the issue.

A dialogue is not negotiation, nor does it substitute for negotiation. Outcomes of the dialogue will not be used to force negotiation outcomes. It is meant to enrich understanding if each other's perspectives and to seek common ground and to learn to be able to live with the differences. Why is a dialogue necessary? The Two Cultures theory developed in 1964 postulated that there is a vast difference between the academic culture and the policy culture. The academic culture is slow, focused on complexity and especially on theoretical complexity, inward looking, and aims at reviewed publications. The policy culture is different. Policymakers look for fast, simple solutions to policy problems that are easy to sell to others; they never read reviewed journals and focus on practice. Forty years later, we are not just talking about two conflicting cultures that cannot easily communicate with each other. Scientists are only one source of information, other professional communities have their own professional cultures, people have their own cultures, and cultures vary within and between nations and blocs. All this leads to a pluralistic, multinational culture conflict.

In complex issues, the question is: can scientists provide unbiased and objective information? They tend to think so; and often there are strong vested interests in each discipline to keep the discipline pure. Political scientists either argue that there is a strong fact value dichotomy, or they argue that science itself is highly value laden and its claim to objectivity cannot be accepted without proof.

How do policy makers then use this science? The Two Cultures theory argued that it could frequently not be used since it is not user friendly. Normativists argue that knowledge is used in the public interest. Rational actors modellers believe that knowledge is only used if it conforms to the interests, intuitions and beliefs of the policy maker. Public choice theorists argue that knowledge is only used if it conforms to the private interests of the policymaker. Critical theory argues that policy is the outcome of politics, not expertise. These theories have developed mostly within the context of domestic science-policy interface. At international level, we see a slight difference of perspective. For the neo-realist science does not have an independent influence on policymaking. For the historical materialist, if science has an influence it will not be in the interests of the South. For the neo-institutionalist, science has an independent influence especially in benign issue areas. For the idealistic supranationalist science should focus on global interests and be adopted by global institutions. For the cognitivist, science influences scientific and policy communities through networking and can have thus a much stronger influence.

What the above shows is that science is not seen as the only source of information for decision-making, nor is it seen as providing the objective knowledge necessary for global decision-making. Policymakers too are influenced by a number of factors in making their decisions. Given that the problem of climate change is asymmetric in nature, that is that all countries will face vastly different types of impacts from the problem, it is more than likely that the issues facing these countries will be very different. Policymakers may find it extremely difficult to reach problem solving unless they engage in a constructive dialogue to understand what the different parties think.

In fact a dialogue is necessary when the science and values in a problem are highly controversial; when the issue is highly politicised and contemporary; when potential solutions are not immediately visible, feasible or acceptable, when the stakes are high and decisions urgent, when the effects are remote in time and space, when the impacts vary considerably between the centre (developed countries) and the periphery (developing countries).

Dialogues are in fact becoming increasingly common these days. Many of these are being initiated by the policy community. Thus we have the dialogues initiated by the World Water Forum, the Water and Climate Dialogues and the dialogues of the World Summit on Sustainable Development. We have also some science-initiated dialogues such as the COOL Project (Climate Options in the Long Term).

The purpose of the dialogue is to provide a non-confrontational setting for an informed discussion. Participants do not represent national or other interests, their opinions will not be cited out of context, nor will they bound by any of the outcomes of the dialogue. The main product of the dialogue is the dialogue itself and the accelerated learning process that is hoped is thereby initiated. There is no need to reach consensus; the only real measure of success is that the process reaches a situation when people understand the perspectives of others and learn to respect them, even if they cannot accept them.

1.4 Introduction to the workshop (2): Some introductory comments on Article 2[2]

Following this theoretical introduction, Bert Metz presented some background information on the background of the HOT project and the key issues that need to be kept in mind in articulating Article 2.

He started with reviewing the various elements of Article 2. He stressed that Article 2 not only refers to the risks of climate change for ecosystems and food production, but also to the risks related to climate policies. These policies should also enable economic development to proceed in a sustainable manner. This means that a balance is sought between the risks of climate change and implications of climate policies. With respect to the risks of climate change he used the colouring scheme from IPCC's Third Assessment Report (TAR) (see Figure 1.1), in which the knowledge about the risks of climate change has been summarised according to 5 different reasons for concern:

1. Risks to unique and threatened systems, (e.g. coral reefs);
2. Risk from extreme climate events (e.g. heat waves and storms);

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[2] By Bert Metz, RIVM.

3. Distribution of impacts (e.g. more negative impacts in developing countries);
4. Aggregated impacts (e.g. for economic sectors);
5. Risks of large-scale discontinuities (e.g. ocean circulation).

With increasing magnitude of climate change, more and more systems are expected to be dominantly negatively affected. Already limited temperature changes as experienced today may, for example, threaten the existence and functioning of many unique systems, like mountain ecosystems or coral reefs. The EU has set as its long-term climate target to limit global average temperature change to less than 2 °C compared to pre-industrial levels, which is less than 1.5°C from 1990 levels. The figure from the IPCC indicates that this target poses already significant risks to unique and threatened systems, results in increased risks from extreme climate events. On the other hand, the risks of large-scale discontinuities seem to remain low as it only increases if the temperature rises more than 2 - 3 °C compared to 1990 levels.

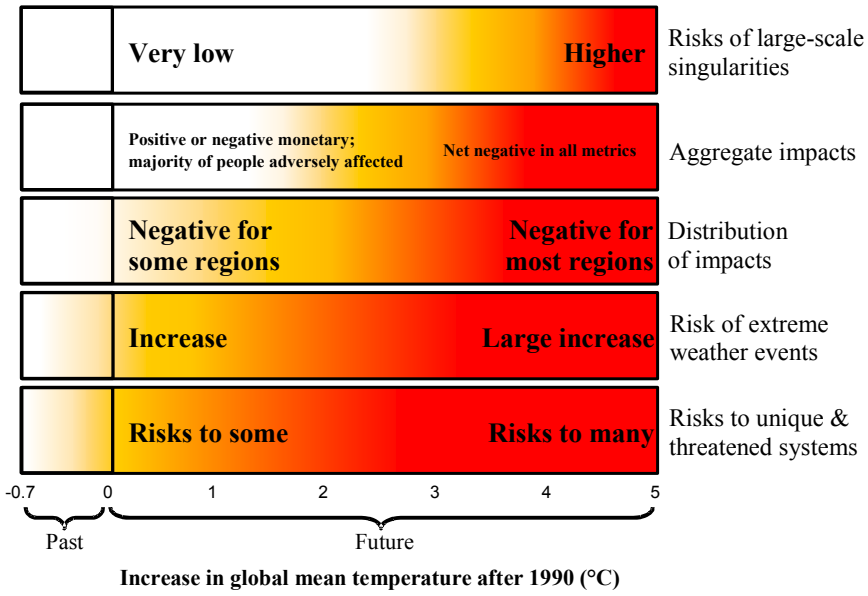

Figure 1.1 Climate change risks (source: IPCC-TAR, 2001).

He next discussed the relationship between the global average temperature change and levels of stabilising greenhouse gas emissions. This relationship is still very uncertain due to the uncertainties in the sensitivity of the climate system. The higher the level of stabilisation the larger the difference between the level of warming in 2100 and the equilibrium temperature change on the very long term. He highlighted that if the climate sensitivity is high even a stabilisation of the CO_2 concentration at 450ppmv may not be sufficient to avoid exceeding the 2°C level on the long-term. He continued with indicating the implications of the various stabilisation levels for CO_2 for the allowable emissions pathways during this century. According to the IPCC, stabilisation at 450ppmv would require that global CO_2 emissions would have to peak before 2015 and that thus waiting with mitigating greenhouse gas emissions may foreclose certain policy options. The importance of timely action is also related to the large inertia in both climate and human systems. Even after stabilising GHG concentrations sea level rise will continue for centuries to millennia before equilibrium is attained. The long life times of a major part of the capital stock (like power stations) implies that timely adjustments are needed to avoid

high costs due to the need for premature crapping of existing capital. Metz pointed out that the climate change problem is essentially a risk problem where decision-making under large uncertainty inevitable. It requires a sequential decision making process where no final decisions can be taken, but where options open should be kept open by a hedging strategy and policies should be adjusted overtime according to improving insights in the risks of policy options. In exploring the implications of Article 2 he suggested the use of the so-called SAFE concept, containing the various elements that should be explored in an iterative way for finding solutions for Art.2: ecologically **S**afe, politically **A**cceptable, technically **F**easible, and economically **E**fficient. He finished his presentation with explaining the objectives of the meeting and its programme.

2. Stakeholders perceptions on Article 2

2.1 Perceptions on Article 2: results from a survey [3]

Marcel Berk presented some preliminary results of the stakeholders' questionnaire on Article 2 of the Climate Convention. The questionnaire consisted of mainly open questions and was sent out to approximately 300 people (policy makers / stakeholders in UNFCCC, OECD and EU circles, scientists involved in IPCC). 36 filled out questionnaires had been returned. Some represented views of an organisation or group of persons. Most responses were from scientists (16) and policy makers (14); the number of responses from NGOs was limited (5), while there was hardly any response from business (1). However, the number of people from industry approached was also relatively small. With respect to the geographical representation most responses were from Western Europe (18), followed by North America (7) and other OECD countries (7). There were hardly responses from Economies in Transition (1). Some responses came from persons working for International Organisations (3). The responses thus showed an underrepresentation of views from business, EIT and the USA.

The first question related to the adequacy of the wording of Article 2. Many people think Art. 2 is not adequately formulated or misses important elements for guiding climate policies. Some arguments mentioned include:

- (induced) climate change is already dangerous; goal is to minimise;
- goal should be stabilisation of temperature instead of concentrations;
- conditions formulated too vaguely; too much a diplomatic compromise;
- there is not enough attention for rate of change, irreversible impacts, human health and distributional and scale aspects.

Others noted that the specific conditions mentioned should not be considered inclusive as the first part of Art. 2 is much more general. From the responses it also became clear that the wording of Article 2 is ambiguous. In particular the phrase "to enable economic development to proceed in a sustainable manner" can be interpreted in different ways: as sustainable development or as sustained economic growth.

A second question was when people considered the conditions mentioned in Article 2 no longer to be met. This question posed problems to some people because of the unclear interpretation of Article 2. Some people said that the conditions of Art. 2 to some extent are already no longer met (e.g. vulnerable ecosystems). NGOs indicated that the conditions would no longer be met when temperature increases more than 2 degrees above pre-industrial levels.

Conditions often mentioned included:

- in case of disruption of West Antarctic Ice Sheet, melting of Greenland, change in ocean currents, modification of regional weather systems (e.g. rain seasons);

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[3] By Marcel Berk, RIVM.

- in case of extensive/irreversible damage to ecosystems (loss of species); severe bush fires become commonplace, the biosphere starts releasing carbon;
- when food production/habitats being threatened in various regions/countries due to climate change intensified droughts and/or flooding;
- when island states injure severe damage or become inhabitable due to climate change;
- when climate change results in significant loss of health, economic security/welfare;
- when climate change policies impair development goals.

Someone pointed out that the conditions related more to risks of impacts than to the actual state of affairs, since in that case it would already be too late to take action.

In response to the question at what levels (of scale) Article 2 should be assessed, most people indicated that it should be assessed at all scales. Some said that equity considerations implied that it should mainly be evaluated at the local scale. Some others believed it should only be assessed at a regional/global scale. They indicated that it would be impossible to protect all local ecosystems and food production either because of already induced climate change or because it would be a too stringent criterion. Some mentioned that the appropriate scale also depended on types of risks (e.g. risks to ecosystems: local-regional; risks to food production: regional-global; risks from disruption of climate system/ocean currents: global). Appropriate scales would be rather bio-geographical units (ecosystems) or socio-cultural units (e.g. indigenous groups) than administrative units (like countries). Many people found it difficult to indicate priorities, either because all conditions were considered important or because they were considered interlinked and/or scale/situation dependent (e.g. depending on the most critical condition). A number of people, if needed, would give priority to ecosystems because of the lack of options for adaptation and the possible irreversible nature of impacts. Generally, food production was considered a high priority, but intrinsically linked with sustainable development. Some gave it less priority at a local scale as food security could be attained via redistribution and trade. Some respondents gave a low priority to the economic conditions, noting that not all economic activities can be considered sustainable and may be substituted by other activities.

A fifth question concerned unacceptable outcomes of climate change policies. Outcomes referred to by a number of people include:

- no significant emission reductions;
- main polluters not participating in taking action;
- increasing the N-S welfare gap and poverty in developing countries;
- policies that do not allocate costs and benefits in an equitable manner; and
- policies that do not take national circumstances into account.

Other outcomes mentioned were the destruction and depopulation of small island states, policies resulting into large number of environmental refugees, policies resulting in irreversible impacts (e.g. loss of species, habitat/culture), policies ignoring the risk of high impact - low probability events, policies discouraging/impairing economic growth and putting an unreasonable burden on civil society, and policies leaving future generation with unmanageable risks and costs.

A sixth question related to the distribution of costs of mitigation and adaptation. Some misinterpreted this question as prioritising funds for mitigation or adaptation instead of the allocation of costs among countries. Many people referred to the principle in art. 3.1 UNFCCC of "common but differentiated responsibilities" and proposed to share mitigation costs proportional to emissions (polluter pays principle) and ability to pay and to respect development needs of developing countries. Other burden sharing criteria mentioned include: historic/future contribution to warming, per capita emission allocations, mitigation capabilities, and willingness to pay. Some suggest a balance between various equity principles. Regarding adaptation costs many feel that these should be born nationally, but with (substantial) relief for the least developed countries. Some said those benefiting from climate change should not be exempted from neither taking action nor being compensated.

A next question concerned controversies to be expected when discussing Article 2. Here items often referred to included:

- lack of consensus on defining criteria for "dangerous interference";
- differences about proper scale of assessing "dangerous interference";
- valuation of non-monetary impacts (ecosystems, culture) versus monetary impacts;
- lack of consensus on the concept of sustainable development and its priorities (food versus nature);
- differences about dealing with risks/scientific uncertainty (e.g. attribution of negative changes to (anthropogenic) climate change);
- differences about feasible and acceptable levels of adaptation and mitigation;
- differences in interests between countries in mitigating climate change;
- definition of equity; and
- burden sharing of mitigation and adaptation costs.

A next question was about what information is most needed for elaborating Article 2. This question resulted in a long list of information needs:

- Information to define valid and workable indicators for assessing local/regional vulnerability and adaptive capacity;
- Information to define target-loads (e.g. % percent at high risk of X or Y; compare critical loads for acidification);
- More information/confidence about levels of risks from climate change at the regional level in relation to various concentration stabilisation scenarios;
- More information about changes in risks from extreme events;
- More information on critical thresholds for irreversible systems change;
- More information about the CC risks and value of losses in ecosystem functions;
- Methodologies to factor out (anthropogenic) CC stress component of impacted categories (e.g. food production);
- More information about the "real" socio-economic costs of significant reductions of GHGs (not just economic modelling);
- More social science information (e.g. on risk perceptions and social tolerances), and
- Integrated inverse impacts analysis (from critical stress levels to likelihood of exceeding these for various emission levels (including subjective assessment of levels of confidence).

Finally, people were asked what issues they considered important to discuss during a first dialogue workshop. This resulted in a broad list of issues. Some issues related to the contents of the dialogue, such as:

- whether Art. 2 is a useful starting point for defining long-term climate policy objectives;
- how to clarify what constitutes "dangerous climate change";
- how to define (practical and realistic) criteria for dangerous levels of climate change risks;
- the role of justice in determining dangerous climate change risks;
- the possibilities of science to help define relevant and usable indicators;
- what levels of adaptation are feasible and acceptable;
- how risk theories can help in understanding Art.2;
- appropriate ways to make Art. 2 more meaningful for discussing post-Kyoto policies.

Some other issues mentioned were related to the design and the process of the dialogue:

- how to involve all relevant stakeholders (including indigenous peoples);
- how to account for regional differences in global dialogue;
- what to expect from the dialogue (content, status, role in policy process).

Someone suggested using the workshop to develop a road map for a process to reach agreement.

Finally, some remarkable general observations regarding the results from the questionnaire were made:

- there is no distinct difference in the responses from policy makers and scientists. This may be explained by the fact that many policy makers have a scientific background and scientific advisors;
- there is a large number of people that consider Art. 2 not to be properly formulated, as its language is ambiguous and the conditions mentioned not sufficiently inclusive. Nevertheless operationalising the Article is considered important.

2.2 Some participants views on Article 2

The first speaker was from the NGO community. He stated that in his view the timing was right for a discussion on Article 2. Long-term goals are needed to limit the damage that is already taking place, since the earth was already committed to a certain amount of damage and many communities and species were already suffering from the consequences. The question is thus not if, but how many ecosystems are going to be damaged. He explained that the Climate Action Network (CAN) had recently presented a document saying that the maximum acceptable temperature limit was 2 degree Celsius above pre-industrial levels. He emphasised that this position was not taken because this level was considered safe, but because it was considered already very ambitious to reach. It implies that the global community needs to become engaged in a rapid de-carbonisation process starting now in order to limit global concentrations to below 450 ppmv. Key developing countries will have to start reducing their emissions by no later than 2020/2025. Annex I countries would have to reduce their emissions by 60-80% by the middle of the next century. Climate mitigation was the only emergency exit available. Rapid decoup-

ling of emissions from income would also lead to a fundamental change in land-use policies. An important question for the dialogue is how to deal with adaptation. There is a risk that adaptation policies hamper mitigation action, while there are serious limits to adaptation. The main focus of climate policies should therefore remain with preventive action. He also highlighted that the 2-degree target was far from adequate to save some vulnerable regions of the world from the impacts of climate change. The impacts could already be seen in the Arctic ice sheet.

A dialogue on Article 2 was an important starting point. But who should be the participants in such a dialogue? He felt that the group present would probably be able to come to some common position on Art. 2. It would be necessary to broaden the debate to society at large. In particular, it would be necessary to involve those in the dialogue that make key investment decisions: the ministries involved in economic planning and participating in the development agenda, and industry. While developing countries are the most vulnerable to climate change, the issue is not on their policy agenda. Industry also should be involved. It is in their self-interest to have targets for the longer term, and they need to start realising that Kyoto is just the beginning. At the same time, he noticed that in the environmental NGO community at large climate change was losing importance. Not because it is not considered an important issue, but because of the difficulty of dealing with a remote problem (problem for the future, for far-away countries), making it far more difficult to communicate it to the general public.

The second invited speaker - a policy maker - then presented his views. He said instead of focusing on the fact that the water is boiling slowly in the frog anecdote, we needed to focus more on the cases where the water was boiling quickly - such as the Greenland ice sheet. It is particularly the possible major non-linear climate changes that we need to worry about. In this respect it will be better to agree on a high target than no target at all. However, in his view instead of a top-down analysis it would make more sense to start from a reverse risk analysis, where possible risks and thresholds are identified first and then related to concentrations and emissions. At the same time, it is clear that even at concentrations as low as 550 ppmv the Greenland ice sheet will begin to melt, ecosystems will disappear and some countries will disappear. Thus, there is also a need to think in terms of potential compensation mechanisms for the casualties. He made an analogy with transport risks, saying that people willingly undertook such risks and were willing to bear the consequences. Saying that car driving is dangerous is not helpful in coping with the risks. It was very important in any case to begin to focus on end targets to send clear signals. The Montreal Protocol on ozone depletion is a clear case of how long-term targets can work well in providing industry clear signals. Such targets can also help the discussion on burden sharing. He agreed with the first speaker that the room was full of only people that possibly were a coalition of the willing and many outside would need to be involves as well.

In response to the presentations, a participant noticed that the decreasing interest of NGOs for climate change was not necessarily experienced in central and eastern European countries. These NGOs had less money but were far more focused on these issues. There the key bottleneck is the language barrier. There was an offer made to send out the questionnaires in other languages in the Annex I countries.

2.3 Plenary discussion (1)

The foregoing led to a number of points of discussion and questions:

A technical question related to the issue of the melting of the Greenland ice sheet. It was asked if a 550 ppmv concentration level was only consistent with a 2 degree global warming and if this could lead to the melting of the ice sheet? The answer was that if this 2 degree warming was consistent with a 3 degree warming in Greenland - yes; and models seemed to indicate that this was likely.

One participant wondered if instead of the boiling water, the focus should not be much more on the behaviour of the frog itself i.e. what the man on the street thinks? This is because policymakers only listen to scientists when the public agrees with the scientists. Thus, there is a need for more scientific information about the change in perceptions and behaviour of people in response to information on climate change (in all countries). Somebody considered this as possibly problematic, because the public would have to understand climate change issue first and this is what makes the issue so difficult. However, others agreed that the frog needed more attention and that social sciences may be very useful in providing this information.

It was noted that in some communities it would not be necessary to address the climate change problem by developing long-term targets. In the US the response to traffic casualties was not to set any targets, but to implement a technology-oriented approach. A technology-based approach could serve the purpose just as well. Thus, it would be necessary to broaden the debate on dealing with climate change to various approaches to ensure that it does not become irrelevant for some communities. It was also remarked that in order to appeal to financial ministers it would be necessary not only to talk about risks, but also about costs and benefits. A finance minister is unlikely to support a stringent target if the costs are high and the benefits unclear. This caused some discussion as here participant's views clearly differed. Some agreed that Article 2 includes the balancing of the costs of mitigating measures with the benefits of avoiding risks. Others held the view that one should keep separate what constitutes dangerous climate change and whether the measures to deal with it are affordable. They preferred to move more towards a cost-effectiveness debate. It was pointed out that costs had been no big issue in the case of the Montreal Protocol; when the scientist were clear about the need for action, policy and business followed suit. Some held the view that the reference to sustainable development in Art. 2 meant that the issue should be interpreted beyond the narrow context of just economic costs. One did not need to go down to the level of the finance minister and speak his language; one needed to educate the finance minister on sustainable development. Another argument was that if you were vulnerable to climate change you wanted to know what is dangerous and not that dangerous was defined on the basis of what was considered affordable by some scientific methodology. Others went on to say that there was remarkably little literature on avoidable dangers. The problem with the frog anecdote was that it gave the impression that the water was boiling slowly; but in fact there is no linear progression in the climate change. And even if the earth is warming slowly, any thresholds were being crossed regularly for specific species in specific areas such as the frog itself! Even at 450ppmv CO_2 concentration it is impossible to ensure that sea level rise stops at 1 metre. A 450 CO_2 ppmv or a 550 ppmv for all gases is consistent with the Greenland ice sheet problem; that is a major problem, not one that

can be evaluated in financial terms. All this made one speaker question whether the human race was psychologically able to deal with such a complicated problem - especially if there were going to be a number of abrupt changes in the system. He pointed at the importance of scientists helping to visualise to the public what may happen under different levels of GHG concentrations. Another participant remarked that the problem was that the public is only interested in themselves, and would not support any far-reaching target if it might endanger sustainable economic growth. Policymakers cannot take decisions that the public will not support.

Another issue in the discussion was the issue of scale and equity. The problem with climate change is its asymmetrical nature, with the most vulnerable being the least responsible and visa versa. Regions face different types and levels of problems and different thresholds are being crossed. Which threshold is then to be seen as the most relevant threshold and at what scale should it be assessed? Some suggested not go down too much to the local scale to avoid these insoluble problems; others suggested defining critical thresholds for different regions and systems. It was noted that the equity issue not only relates to impacts but also to mitigation. Communities in some developed countries do not see why they should stop exploiting fossil fuels, when developing countries are allowed to continue doing so. This is considered an important issue even though the same communities may locally suffer from climate change at the same time.

Some participants wanted to know why scientists were constraining themselves in the debate about defining what is dangerous; was it really a too subjective issue or too political for the IPCC? The approach being taken at the workshop appeared to inadequately focus on quantification. They stressed the importance of quantification of Article 2 for helping the policy process further. Numbers mobilised policymakers. Were there no thresholds that could be seen as scientific thresholds? The concept of critical loads from the LRTAP regime could be adopted here. It was noted that the very fact that in dealing with the issue of thresholds Bob Watson (former Chair of IPCC) in his presentation had to use a rhetorical device ("ppmvs - impacts - is this dangerous?") was a striking illustration of the fact that the information cannot be delivered in a straight manner. The information provided by scientists has muddied the process and there is no clear picture. Are scientists constraining themselves, is it a question of the way the IPCC chapters are structures, is it because danger is really a subjective issue, or is it because defining danger in itself is politically complicated and dangerous? Scientists remarked that the scientists had not felt constrained within the IPCC, but that due to the structure of the IPCC there had not been a focus on Article 2. Some scientists stressed that it would not be a good thing if scientists would be given the responsibility to define what is dangerous. In this respect somebody remarked that a distinction should be made between two ways of defining 'dangerous': (i) in the way scientists do, that is by defining the likelihood of severe damage (risk), and (ii) in a value-loaden common usage way, that is indicating when possible outcomes become unacceptable. Scientists should limit themselves to saying what the risks are at various levels of change, not when these become unacceptable. This is the approach that IPCC has been taken as illustrated by the synthesis figure indicating the relation between global temperature change and the levels of the various types of risks. Someone noted that the problem is that the IPCC reports do not explain what can be gained by keeping to lower levels of concentrations, only that costs would go up steeply with lower stabilisation levels. The synthesis colouring figure (Figure 1.1) on

risks relates to temperature change, not to stabilisation levels. Moreover, there is the problem that the scientific literature on impacts at low stabilisation levels is very weak. The IPCC-TAR makes clear that above 3-4 degrees temperature increase (from 1990 levels) overall consequences for all systems become negative. It would already be a major step forward if we could agree that we would want to stay away from a 3-4 degrees temperature increase.

One speaker questioned if 2 Article was ever drafted to be made operative in a formal quantitative way. He thought its function would probably mainly be to maintain pressure on policy makers to take action. Quantification would be difficult. For example, the difference between gradual and abrupt change is often a matter of scale. The loss of individual species already constitutes irreversible and locally abrupt changes. Pressure is needed, and should be provided through scientific information. Science can document what changes there are in ecosystems and managed systems, and try to derive thresholds. If this is put in a graph, the policy makers will be able to use it. This should be done at regional (and local) levels. These refined approaches can maintain the pressure. If science cannot give an answer, the precautionary principle should apply.

There were some other problems flagged in setting numbers. Policy makers are often confronted with very different figures about the costs of stabilising GHG concentrations. In such cases they tend to just split the differences and that can be dangerous. If a stabilisation level would be set there would also be a tendency to fill up the emission space even though the level chosen might turn out to be too high. It seems questionable that international agreement on a stabilisation target can ever be reached when some small island state would have to sign on when their survival is at stake. Perhaps we need to focus more on the social instability that climate change impacts may bring to mobilise policy makers.

It was responded that quantification of Article 2 should start from a common sense approach and focus on debating what climate change risks would be (un)acceptable to the public. Someone suggested following also a bottom up approach where policymakers define what they consider acceptable costs and then relating these to feasible protection levels.

Regarding the question of why industry did not seem interested to participate in the discussion it was postulated that this is because industry wants to be told what the risks are and then define its own future strategy. They do not see themselves as the stewards of the earth defining risks for the community. However, it was generally felt that their involvement would be needed in this debate. This is also an issue of educating people: business representatives often do not understand the long time-scale involved.

3. The structured dialogue

3.1 Introduction to the structured dialogue[4]

The session on the next morning opened with a summary by Joyeeta Gupta of the day before and an introduction to the next session. She indicated that yesterday the approach taken had been one starting from the different interpretations of Article 2 by stakeholders followed by discussing the various arguments for and against these interpretations. This was a rather open and unstructured approach. This approach fits in with looking for common ground by clustering different positions regarding the interpretation of Article 2 and searching for areas of agreement by exploring both the reasoning (reality claims and line of argumentation) behind the different positions and the underlying value- and belief systems involved. She pointed out that today a more structured approach to Article2 would be followed. First the possible contributions of scientific information would be explored. Here Article 2 would be explored from different perspectives: the scientific, ecological, economic, development and ethical framework. Next, participants would engage in a reverse risk analysis approach by identifying relevant indicators for defining dangerous levels of climate change, that could be used for defining critical thresholds/acceptable risk levels and then be related to greenhouse gas concentrations levels. This would be done in outbreak groups.

3.2 Scientific perspectives on Article 2 - an introduction[5]

Alex Haxeltine of the Tyndall Centre for Climate Change Research gave a general introduction on science's contribution to defining "dangerous interference" with the climate system.

The Delhi Declaration on Climate Change and Sustainable Development, which emerged in October 2002 from the Eighth Conference of the Parties to the United Nations Framework Convention on Climate Change (FCCC) reiterates the need to avoid dangerous climate change as the FCCC's ultimate objective. According to the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC), however, deciding what constitutes dangerous climate change is a value judgement beyond the remit of the IPCC and perhaps of science itself. Indeed, there is no universally established methodology or process for deciding what constitutes a dangerous level of climate change, and for whom. Nonetheless, implicitly or explicitly, researchers have suggested arbitrary thresholds in climate change, or in the impacts of climate change, which they themselves designate as dangerous, undesirable or to be avoided. Some examples of definitions of dangerous climate change are:

Danger measured through threshold in physical vulnerability:

- Large-scale eradication of coral reef systems (O'Neil and Oppenheimer, 2002);

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4 By Joyeeta Gupta, IVM.

5 By Alex Haxeltime, Tyndale Centre.

- Disintegration of the West Antarctic Ice Sheet (Vaughan and Spouge, 2002);
- Breakdown of the thermohaline circulation (Rahmstorf, 2000);
- Qualitative modification of crucial climate-system patterns such as ENSO and NAO (Timmermann et al., 1999);
- Climate change exceeding the rate at which biomes can migrate (Malcom and Markham, 2000).

Danger measured through threshold in social vulnerability:

- Irrigation demand exceeding 50 per cent of annual seasonal water usage for agriculture in northern Victoria, Australia (Jones, 2000);
- Depopulation of sovereign atoll countries (Barnett and Adger, 2003);
- Additional millions of people at risk from water shortage, malaria, hunger and coastal flooding (Parry et al., 2001);
- Destabilisation of international order by environmental refugees and emergence of conflicts (Homer-Dixon, 1991; Barnett, 2003);
- World impacts exceeding a threshold percentage of GDP (Nordhaus and Boyer, 2000).

So far most of the scientific research on defining dangerous climate change has focused on what we term external definitions of danger. External definitions are usually based on risk analysis of system characteristics of the physical or social world. Recent work at the Tyndall Centre has emphasised that research on defining dangerous climate change or in developing sustainable responses must recognise the central role played by perceptions of danger. There are therefore competing perspectives on dangerous climate change, what we term 'external' and 'internal' definitions of risk (see

Figure 3.1). Internal definitions of danger recognise that to be real, danger has to be either experienced or to be perceived – it is the individual or collective experience or perception of insecurity or lack of safety that constitutes the danger. A robust policy response must appreciate both external and internal definitions of danger.

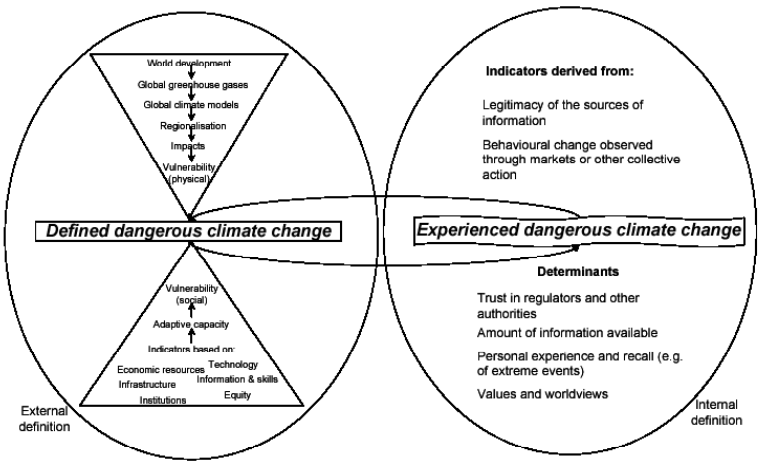

Figure 1. Components of external and internal definitions of dangerous climate change

Figure 3.1 Components of external and internal definitions of dangerous climate change.

The research process leading to these various definitions of danger has followed two different paradigms. The more frequently followed paradigm utilises what we term 'top-down' methods. This framework (upper left triangle in

Figure 3.1) follows an essentially linear approach and quantifies indicators of physical vulnerability based on scenarios of future socio-economic change that are used as inputs to a series of hierarchical models. These types of assessments typically define danger, either globally or locally, in terms of physical measures (e.g. affected crop yield or water availability), threats to the continued function of some part of the non-human world, or in terms of people at risk or reduction in economic welfare. The scenarios used often assume no adaptation will take place as the danger threshold is approached. Sometimes a single adaptation action is assumed and modelled, while a few analyses assume adaptation occurs simply on the basis of rational choice.

The 'bottom-up' approach (as shown by the bottom left triangle in

Figure 3.1) focuses on the social vulnerability of individuals or groups to both existing climate variability and climatic change. This approach tests social and economic theories of the determinants of vulnerability across a region or between socio-economic groups, leading to social indicators of danger and vulnerability such as poverty, lack of access to health or other services, or lack of empowerment. This approach also uses reasoning by analogy, i.e., learning from past experience of how communities have coped with extreme events. In contrast to 'top-down' methods, recognising adaptive capacity is usually implicit in such approaches.

There are also a few attempts to integrate these two approaches to try to derive a more holistic definition of vulnerability for the purposes of adaptation to a changing climate. While recognising the scientific value and policy relevance of these research efforts, all these definitions of danger remain 'external' in the sense that they are observed or modelled according to judgements of individual or collectives of scientists. But danger can also be defined in terms of insecurity or lack of safety. So, for example, in the context of climate change it is the perceived insecurity arising from realised or anticipated impacts associated with changing extreme weather events, and often immediate threats to life and livelihood, which are of greatest concern to individuals or, collectively, to society. This definition of dangerous climate change is therefore based on psychological, social, moral, institutional and cultural processes that influence perceptions of individuals and societies about what constitutes danger. The perceptions of danger are determined by personal experience, values, information and trust (

Figure 3.1).

These external and internal definitions of dangerous climate change interact with each other. Perceptions of what is dangerous are, to an extent, informed by a technical analysis of risk (external definition), for example as provided by the IPCC in the form of a state-of-the-art assessment of the science of climate change. The amount of information, the legitimacy of who gives the information and the other determinants shown in

Figure 3.1, will transform this external definition into perception of what constitutes dangerous climate change (internal definition). Information on the risk of an individual's house being flooded or discussion about the widespread collapse of coral reefs, for example, do much to formulate perceptions of danger. Conversely, societal or individual perceptions of what constitutes dangerous climate change will have an impact on the way it is researched and externally defined, hence the arrows between the two definitions in

Figure 3.1. A further dimension of this analysis is the role of expectations and how external definitions of danger can change individual behaviour. The prediction that an atoll country would become effectively uninhabitable through reduced land area and water availability, for example, could change behaviour such that resources would be over-exploited making the uninhabitability more likely and the prediction self-fulfilling.

These examples show that definitions of dangerous climate change are socially constructed and involve deeply reflexive processes made up of the interplay between external and internal definitions. Thus climate change science exhibits the classic characteristics of strong uncertainty and of a 'post-normal' science in terms of framing and execution of links to public policy.

What can be the role of science in defining dangerous climate change? First it is clear that no objective definition of dangerous climate change is possible. The concepts of danger will always be deeply value laden. Within the scientific community we can characterise three groups of approaches: the ecological approach, the economic approach and the ethical approach.

The ecological approach focuses on the selection of thresholds for ecosystem adaptation. It selects key ecological/physical thresholds beyond which impacts are deemed unacceptable. Examples range from rates of biome migration to eradication of coral reef systems. Such thresholds can provide 'markers' for policy.

The economic approach focuses on welfare impacts or optimisation under climate change. It seeks to optimise welfare for costs of damages avoided versus the costs of mitigation, but may also provide thresholds by indicating when (net) economic losses exceed a threshold of GDP. Ecological scientists and physicists tend to find this approach problematical, but economic valuations are very attractive to the policy process.

The ethical approach focuses on issues of equity and justice. It suggests that actually the more fundamental issues are to do with values, equity and justice. Examples include the analysis of the impacts of climate change on atoll states' cultures. It leads away from a positive approach to defining dangerous climate change and puts emphasis on the decision making process of defining dangerous climate change. Definitions of 'danger' must be negotiated by groups of people with very different priorities. Such a dialogue/process may be framed by science-based or non-science based frameworks. Such an approach also tends to relate to internal definitions of danger as people have different thresholds for action/attitudes to risk.

In conclusion:

- Defining dangerous climate change must be done within a reflexive science framework that acknowledges that no positive concept of danger exists.

- A distinction can be made between internal and external definitions of dangerous climate change. This distinction is just a conceptual device – how to relate the two is the challenge. However, more research on the internal definitions of danger is needed.
- The ethical approach makes clear the importance of procedural justice in defining dangerous climate change.
- Ecology, Economics and Ethics all should contribute to the dialogue, but this is not the same thing as the dialogue taking place within a science-led e.g. risk analysis framework.

After this general introduction, other scientists were provided the opportunity to make additional contributions from various perspectives.

3.3 An economic perspective on Article 2

Professor Robert Mendelsohn gave a first presentation from an economic perspective. He pointed out that climate change policies will inevitably involve a learning process: finding out what is happening is difficult, uncertainties are large and to see in the future is even more difficult. Whatever limit we would state for greenhouse gas emissions would not be a definite limit, because there will be new knowledge and insights.

In assessing the economic impacts of climate change, for example on agriculture, there are two possible methodologies, each with their pros and cons. One approach is experimentation, where insights from the lab (e.g. related to the impacts of temperature change on agricultural crops) are extrapolated to the real world. Its strengths are: control of unwanted variables and possibility to create new conditions. Its weaknesses: difficulty in including adaptation and few cases/sites make it hard to generalise from. Another approach is cross-section analysis. In this approach insights from real situations elsewhere are used to model behaviour under changing conditions. This approach includes adaptation, but does not study the response to new conditions, or the mechanisms behind it and offers poor control of unwanted variables.

These are two ways of figuring out how bad climate change may be. However, it remains difficult to determine thresholds for dangerous climate change: often the responses are gradual. One problem is that not everybody is in the same game. For cold regions (high latitudes) climate change will generally be beneficial for agriculture, while for warmer regions, like Southern Europe (middle latitudes) climate change will be beneficial on the short-term, but detrimental on the long term, while for tropical regions (low latitudes) the situation will only get worse. The distribution of impacts thus makes equity a major issue. However, we should not mix up equity and efficiency. Efficiency relates to what is best for the world, while the equity issue relates to how to compensate those worse off.

Recent cost-benefit analyses indicate that a moderate climate change of up to 3^{o}C could be beneficial on a global scale. However, there will be differences between regions. A 5^{o}C temperature increase could still be beneficial for higher latitudes, but will be very negative for low and middle latitudes. This suggests that there are no clear economic reasons for climate change to be stopped at <u>all</u> costs. Mitigation is also not a good tool to deal with problems related to an uneven distribution of impacts; for this compensation is a cheaper and more adequate solution.

3.4 A physical-ecological perspective on Article 2

Professor Oppenheimer next provided a physical-ecological perspective on Article 2. On the physical/biological side there are certain thresholds that could provide guidance in defining dangerous climate change, but in many cases they are hard to define. Coral reefs come closest to clear thresholds. Regarding the stability of the West Antarctic Ice Sheet (WAIS) and the North-Atlantic Thermoline Circulation (THC) this is less clear, because the present models still give too poor results for making precise estimate.

There is a clear difference between real physical threshold levels and regulatory (policy) threshold levels. If you have determined the physical thresholds, there is still a lot of variability in the climate system requiring including a substantial margin in defining regulatory (policy) thresholds. Even then there will remain uncertainty about the actual behaviour of systems. Thus uncertainty about the physical thresholds is no reason for not setting (provisional) regulatory thresholds.

There is a tendency to think in terms of temperature instead of concentration targets. He doubts that this is a good thing, because temperature change is not a good indicator for all impacts (e.g. run-off, frequency of extreme events). The impacts are regional and temperature is more variable than concentration levels.

There are serious limitations in adapting to climate change. Adaptation will not take place in an informed rational, but rather chaotic way. It will be based on private rather than on a collective response and not always be beneficial. It has to be planned well.

3.5 An equity perspective on Article 2

Dr. Jon Barnett set out some equity issues. He started with emphasising that the dialogue should make participants reflect on the values involved in defining acceptable and unacceptable climate change impacts. He suggested that participants probably had come because they feel that climate change is a problem that affects values that they care about.

To avoid the mistake of limiting the discussions to the technical properties of elaborating Article 2 he pointed out that a distinction must be made between why and how we do things. Defining danger must be an answer to the why instead of the how question. The starting point should be: “I think CC is a problem, because….”, and to then say what is (un)acceptable. Art. 2 is the moral test to say what is wrong, which is a political decision. In his view last night’s discussions had focused too much on the ‘how’ question only.

It is misleading to say that climate change is a global problem, because the impacts are very unevenly distributed. The rich countries, while responsible for most carbon emissions, have a high adaptive capacity go limit the impacts of climate change. In contracts, the poor countries are much more vulnerable because they are ecologically more sensitive, economically more dependent on primary products, and have a low adaptive capacity. This makes the justice issue a crucial element in the discussion on Article 2. In looking for climate policy targets a justice approach would start with identifying those who are most vulnerable, and considering their adaptive capacity in defining thresholds.

3.6 Plenary discussion (2)

The scientific contributions, in particular the one on the economic perspective, resulted in a heated discussion. A number of participants felt that the cost-benefit perspective and the conclusion that limited climate change could be overall beneficial on a global scale was misleading and incorrect. Also the idea that compensation to those less well off would be economically a more rational strategy was debated. Compensation was not considered better than mitigation for a number of reasons. While the idea of compensation was considered interesting because it meant holding the polluter accountable, it was strongly doubted that in reality compensation would ever be paid. It was also pointed out that politically more than just economic considerations count. GDP was not considered a valid metric for evaluating all impacts. While a warming of higher latitudes may in some cases be economically beneficial by improving agricultural conditions and opening up sea routes, it at the same time would result into the disruption of indigenous cultures. Social and ethical issues should thus be taken into account as well. Moreover, the presented figures were questioned. It was argued that economists usually ignore the co-benefits of mitigation and overestimate the costs. The estimated impacts of climate change can be much less beneficial or more negative if based on stochastic changes in climate variability instead of projected gradual changes in average values. In response, it was acknowledged that the distribution of non-market impacts could be uneven and that compensation would not in all cases be satisfactory. However, event though the figures presented are rather uncertain, the general message remained that from an economic point of view a mild climate change (up to a few degrees temperature increase) was likely to be beneficial on a global scale.

3.7 Group sessions

After the break the group was split up into two groups to explore possible indicators for identifying dangerous levels of climate change. The first group focused on indicators for impacts on ecosystems/and non-linear changes in the climate system. The second group focused on impacts on human systems. After the break out sessions the results were reported back and discussed in the plenary.

3.7.1 Indicators for impacts on ecosystems/non-linearities in the climate system – results from Working group I

In the first Working Group on indicators for impacts on ecosystems/non-linearities in the climate system a number of issues were discussed.

- Input variables (e.g. temperature and sea level), and output variables (e.g. species, habitat);
- Look at the ecological effects of CC;
- How much area loss is acceptable (10, 20, 50%?);
- Net Ecosystem Production (NEP) is better measurable than Net Primary Production (NPP), which says nothing about the carbon flux;
- Ecosystems change even without CC. It is difficult to separate CC from other factors (attribution problem);
- A distinction must be made between criteria and impacts. Now the criteria are a mix;

- Models are underestimating effects of CC. So there is a need to look at large and small scale changes to see how/if the climate is changing;
- The group identified a number of criteria for indicators:
  - Indicators should be measurable and/or modelling should be possible;
  - It should be clear what level could be considered dangerous;
  - changes in the value of the indicators should be attributable to climate change;
  - they should have appeal to the public.

This discussion led to the following outcome:

Table 3.1 Outcomes Breakout Group 1.

Criteria considered most relevant	Scale	Quantification
NEP loss, including disturbances	Regional and global	Δ NEP over time, until it becomes negative
1. Habitat loss	1. Regional	1. Loss of areas with high number of endemic species
2. Species loss	2. Regional and global	2.a) Loss of charismatic flagship species (polar bear, etc.) 2. b) Loss of keystone species
3. Species health	3. Regional and global	3. Frequency of coral bleaching
Sea level	Regional	- Net sea level rise - (Amount of submerged land)
Ocean circulation	Regional and global	
Water cycle change and run-off	Regional	- Frequency of flooding - Summer run-off - Rainfall pattern - Frequency of droughts - Extreme precipitation events
Cryosphere stability	Regional and global	- Regional glacier loss - Ice sheet stability
Precipitation/Intensification/Extreme events	Regional	- Frequency of storms - Frequency of surges - Intensity
Criteria considered less significant		
Pests		
Ecosystem nutrient state		
Habitat fragmentation/Ecosystem adaptability		
Phenology	Regional	
Rate of climate change		
Structural ecosystem change		

Temperature
Biodiversity

3.7.2 Indicators for impacts on human systems – results from Working Group 2

In Working Group 2, indicators for the impacts on human systems were discussed. Discussion points included:

- Food production or food security in vulnerable regions (like Horn of Africa) as criteria (if there is a difference between the two). Food security is not as good as food production in defining dangerous situations at the local level. While the problem is not the production of food but the problem is the distribution of food, food production (at the local and regional scale) is probably the most relevant and workable indicator of CC impacts on social systems.
- Another criterion can be the impact on indigenous people. This is related to the food production issue as local food production often affects the possibilities of preserving cultures.
- Criteria have to be attributed to CC. Food indicators are best attributable to CC, migration is too complex to be attributed to CC. Although attribution is a problem in general, in some areas (e.g. Arctic areas), the impacts are very attributable. Attribution might also not be a problem in areas where e.g. droughts have been common for several decades. To deal with the uncertainty in attribution one could use probabilistic methods or use the IPCC-TAR ranges (high/medium/low).
- The level of aggregation. Policy makers are interested in 3 types of levels (if it can be attributed to CC)
- A distinction can be made between different types of indicators / threshold levels with different functions: observable (early) warning level indicators (e.g. malaria in France) to raise public awareness; maximum acceptable levels of CC to use for target-setting, and no-go area indicators, indication events or levels to avoid (red alert levels, e.g. no food production). We first need the warning level indicators. Indicators for the last need to be very predictable. The middle ones we have to be quite confident on. Such indicators could be not need to serve all levels of scale.
- Some indicators, like food production are rather slow indicators. It may be useful to look at underlying factors that are providing more early warnings.
- For policy makers it is important that the indicators are very clear and not confusing.
- An important question is how to deal with adaptation. How can you account for various options for adaptation measures? Adaptation is in principle frozen for this exercise. This is difficult assumption, though, because adaptation is very important in determining what is dangerous (impacts could be easy to adapt to). So indicators have to include indications of adaptation.
- Another thing that has to be taken into account is a risk analysis. What is the range of the risks? What is the likelihood of the impacts being triggered?
- Different criteria for indicators were identified. Indicators should be:
  - measurable;
  - predictable/reliable;
  - attributable;

  - transparent;
  - have public appeal.
- Apart from local and regional indicators there is a need for aggregated indicators, or methods on how to aggregate. These could be based on the amount of people or area severely affected. What would be considered severely could then be decided upon at a later stage. This approach works well in the area of noise pollution and seems interesting to explore in the case of climate change.

The discussions resulted into two tables, with the first being integrated in the second.

Table 3.1 Outcomes (1) Breakout Group 2.

Important criteria	Scale	Quantification
Food production:		
- Food shortage		
- Distribution		
- Self sufficiency		
- Crop migration		
Health:		
- Illnesses (insect-born diseases)		
Water		
- Freshwater availability		
- Water quality		
- Water shortage		
Population displacement/Refugees:		
- Internal		
- External		
Loss of culture		
Economic losses		
Ecological services:	Regional	
- loss of forests		
Other criteria:		
Final energy consumption		
Extreme events		
Transboundary air pollution		
Persistent Organic Pollutants		
GDP		
Human Development Index (HDI)		
Life expectancy		

Table 3.2 Outcomes (2) Breakout Group 2

Art. 2 categories	Criteria	How to measure? (*1,2,3,4)	Criteria for criteria (*5,6,7,8,9)	Threshold levels (*10,11,12)
Food	Food			
	Extreme events			
	Infestation (pests)			
	Water			
Ecosystem	Ecological services			
	Extreme events			
Development	Health			
	Loss of culture			
	Extreme events			
	Displacement			
	GDP			
	Livelihoods			
	Coastal flooding			

Notes Table 3.2

*1,2,3,4: Indicators of measuring impacts:

1. Number of people seriously affected
2. Income effects/Damages
3. HDI
4. Built environment

*5,6,7,8,9: Criteria for determining appropriateness of criteria:

5. Measurable
6. Predictable/Reliable
7. Attributable
8. Transparent
9. Public appeal

*10,11,12: Different threshold levels:

10. Early warning levels
11. Maximum acceptable levels
12. No-go levels

3.8 Plenary discussion (3)

Generally, there seemed quite some agreement about the criteria for indicators to be selected. At the same time the discussion indicated that there are a number of difficult issues in identifying suitable indicators and indicator levels.

- How to take adaptation into account? This is particular of importance for the risks to human systems. What levels of adaptation can be expected and would be acceptable in setting target levels for indicators?

- Risk perspective. Many indicators are related to climate variability. This implies that a risk approach will be needed. Risk analysis should provide information about the likelihood of indicator levels to be exceeded.
- Attribution. Many indicators relate to events that are not only related to climate change, thus making it complicated to attribute impacts to climate change.
- Level of aggregation. What is the most proper level of aggregation for indicators to be significant, representative, transparent etc.
- Public appeal. There may be a pay-off between scientifically most credible indicators and those apprehensible to the general public.

It was noted that the attribution aspect becomes easier to handle when indicators are model-based outcomes. In any case the credibility of an indicator to the public will be very important. The suggested distinction between early warning, policy indicators and no-go area indicators could be very helpful in this respect. Each set serves different purposes. Early warning indicators may be very important for raising public awareness and support by indicating that there is significant change, but need not necessarily to be pointing at dangerous levels yet. Policy indicators will have to be based on model-based predictive indicators that may have less public appeal but can be related to (long-term) policy targets. Regarding the problem of attribution it was noted that this is less a problem in the case of early warning indicators: you don't need to attribute the increase in insurance costs due to extreme weather events to climate change to make clear that things are going in the wrong direction. Someone suggested dealing with the attribution issue in the way IPCC deals with climate impacts: by indicating levels of confidence. It makes no sense to look for perfect approaches. One could also think of probabilistic early warning indicators: indicating that there is X% chance that there is a significant change in for example precipitation (related to climate change).

Regarding the issue of aggregation it was remarked that we both need single and aggregated indicators. Marginal indicators (like the loss of key species or cultures) cannot be aggregated, while aggregated indicators can help making the attribution case stronger. However, in the case of economic aggregations - like in cost-benefit analysis - it was considered important that the way things are being aggregated remains transparent.

From the reporting of the subgroups no fundamental different perspectives in the subgroups appeared. This might be related to the fact that the groups did not really have to prioritise or to agree on setting specific indicators threshold levels. In subgroup 1 the issue of substitutability regarding ecosystems loss did arise.

3.9 General discussion on approaches and indicators for operationalising Article 2

In a final discussion session the debate was broadened again to both issues of impacts, adaptation and mitigation. A central question was when Climate Change policies would be considered sustainable or unsustainable.

Sustainability criteria for climate change policies

It was noted (again) that Article 2 is ambiguous about sustainable development. It can be interpreted as both sustainable development as well as sustained economic growth. From the first perspective, safeguarding sustained economic growth would not be justified

since the present fossil-based economic system is not sustainable. It was remarked, however, that while shutting down fossil power plants might be sustainable, it would not be realistic. Others argued that the alternatives might not be considered sustainable either, like nuclear, large-scale hydro and biomass plantations (competition for land). Moreover, it would result in large income losses for fossil energy exporters, well beyond levels resulting from market fluctuations that might be still be considered acceptable. This raised a discussion on what mitigation policies would not be considered sustainable. One participant indicated that in his view policy options with unforeseeable and irreversible implications like geo-engineering or CO_2 storage in oceans, and policies stopping the transition to renewables would not be sustainable. Another participant held the view that climate change policies should not hinder the ordinary lives of people, either legally (restricting the freedom of behaviour) or economically (making things to expensive). Ultimately policies will be steered not by what is sustainable but by what is acceptable. Some participants stressed that the investment costs for mitigating climate change are no real problem and will pay themselves back, particularly when ancillary benefits are accounted for. A key criterion would be to keep the prices of energy services affordable, particular in developing countries, because then economic development would not be impeded. Some participants mentioned that climate policies also should not result into high regional concentrations of unemployment, e.g. due to a too fast reduction of fossil subsidies or shutting down of coalmines or other fossil intensive activities. There should be sufficient time for restructuring economies. Finally, it was remarked that international climate policies should prevent too high levels of carbon leakage to (developing) countries without commitments as that would make polices ineffective and result in unnecessary costs. In response, another participant noted that stringent polices in developed countries could result in substantial technological spill over reducing the emission intensities of developing countries economies.

Interestingly, economic loss - in terms of GDP growth foregone - was not mentioned. It was noted that costs are only relevant in relation to the benefits or risks perceived. Moreover, the key question is costs for whom rather than overall GDP loss. Social indicators of climate policy impacts take this better into account. With respect to the burden sharing the proportionality principle seems very important.

Balancing risks and costs

How could the risks of climate change be balanced against the costs of climate policies? One participant thinks that it will be difficult to balance risks and costs in a formalised way within the UNFCCC. Such a process is complicated by differences in the sensitivities of various natural and social systems and in regional vulnerabilities. It seems unlikely that a quantitative assessment of Article 2 will be part of the negotiation process. For example: small island states could not accept any targets that would compromise their very existence! Scientific information about risks and costs will be processed by the IPCC, and that information will then help in putting pressure on the policy process to act. One of the participants does not agree. He thinks that long-term policy targets will be needed to guide the negotiation process on short-term policy decisions. A too strict and formal approach for trading off risks and costs - like cost-benefit analysis - would be unwise, but an open assessment within the UNFCCC process would be valuable in order to build consensus on restrict the range of acceptable long-term options. Another partici-

pant fears that such a balancing will be hampered by major scientific uncertainties, in particular regarding possible breaking points in systems responses. However, he feels that options for long-term climate goals should be left open. One scientist points out that based on present scientific knowledge a formal CBA may indicate that we do not yet need to do a lot. Another scientist points out that the outcomes are likely to be quite the opposite if large-scale non-linear climate system changes are accounted for – even if only a low probability is attached to them. Others also feel that CBA does not provide a politically realistic approach for balancing risks and costs of climate change policies. It ignores too much the re-distribution and ethical issues that will be central to policy making. CBA is not well suited to deal with climate change because of the many different metrics involved, many of which are hard to be monetised. Many participants feel that there will be a need for multiple approaches and metrics. Transparency will be very important to make all information assessable. The issue of how to manage distributional effects of climate change and climate change policies needs much more debate.

4. Evaluation of the workshop and the lessons for the global dialogue

4.1 Evaluation of the workshop

The last session of the workshop was devoted to evaluating the workshop and gathering ideas for designing the global dialogue. In addition to the plenary evaluation information was also gathered via an anonymous evaluation questionnaire at the end of the meeting.

4.1.1 Results from the plenary evaluation

Regarding the contents of the meeting it was generally felt that it had been good to bring different political and scientific perspectives together. This had resulted in a lively debate and helped in the sharpening of arguments. However, it was suggested to involve more scientists from more diverse disciplines next time (e.g. from social sciences). There was also a feeling of confusion about the outcomes of the workshop. Partly, this was related to the complexity of the issue, but also due to some lack of clarity about the subject of the project itself. Did the project intend to talk about the interpretation of Art. 2 (in a narrow sense) or about the broader debate about long-term climate targets and strategies? The dialogue itself was generally well appreciated, in particularly the one on indicators. It was noted that there was a need to better distinguish between indicators and long-term targets. The discussions on indicators had been mainly on the selection of indicators; some had hoped it would have been more about critical/acceptable levels as well. At the same time, it was felt that there was (still) a lack of solid ground for setting levels for indicators.

With respect to the dialogue itself, the participants were positive about the group of people gathered at the workshop. They considered it a good mix of well-informed and relevant policy makers, stakeholders and scientists. However, the group was not considered diverse enough: there was too much consensus and important stakeholders were missing (business, economic ministries, indigenous groups). The interaction between scientists and policy makers was viewed as very positive. The debate itself had been open and constructive, without reiterations of positions. However, some felt that the discussions sometimes were too broad and could have gained from a clearer definition of envisaged outcomes and more structured moderation.

4.1.2 Results from the evaluation questionnaire

Generally, the results from the questionnaire confirm the expressed high appreciation of the participants of the workshop, but also contained some more critical remarks about the process. Most participants rated the workshop ‘good’, some ‘very good’ and no one as reasonable, poor or bad. The workshop also met most participants’ expectations, although some indicated to have expected to talk more about economic and political aspects (barriers, (un)acceptable levels of climate change impacts). All participants very much enjoyed the open and constructive atmosphere that was experienced as stimulating. At the same time, they experienced that the complexity of the issue requires much more

time for elaboration and a proper structuring of the discussions. Some participants indicated that the goals, set up and envisaged outcomes of the meeting could have been made clearer. The structure of the meeting did not always seem to be clear to all participants. Nevertheless, all sessions of the programme were well appreciated, in particular on contents and the moderation. Time availability generally got a lower rating.

The session on stakeholders' views went very well, although the discussion sometimes lost its focus and could have been more structured. Regarding the session on the role of science the responses indicated that participants differed in their reception of the presentations. Some were positive about the social science input, while others had rather expected a systematic overview of the state of science to help quantifying indicators for dangerous climate change. The economic presentation was received by some as too controversial and one-sided and some would have preferred alternative perspectives. The results of the questionnaires on the two breakout sessions indicate a clear difference in appreciation. The group on impacts on human systems had more difficulty in structuring the discussion and the identification of proper indicators than the group on climate and ecosystems impacts. This seems reflected in the appreciation of both contents and moderation of the session. Nevertheless the breakout sessions were still much appreciated for helping making discussions on Article 2 more concrete and clarifying positions. However, the time available was generally considered insufficient to reach an adequate level of depth and reflection. The session on balancing risks and interests focusing more on the sustainability of climate policy responses also received somewhat mixed responses. Some considered the discussion less relevant or too general. For some, the relationship with Art. 2 was not clear enough. Some of the confusion seemed related to the ambiguity in the wording of Art. 2 (particularly related to the interpretation of sustainable economic growth) and the mixing of the criterion of sustainability and that of acceptability. The final session on the follow up of the workshop and design of the global dialogue was rather short but well appreciated (by those still attending). It was felt that a follow up would be very valuable and that good suggestions were made.

Regarding the outcomes of the workshop most respondents indicated that they gained a better understanding of the views of other participants and learned that views are quite diverse. Many participants also indicated that the workshop had produced new ideas or insights. Some indicated that while there may be no new ideas, the workshop had helped in clarifying positions and arguments or deepened their understanding of the issue. However, only few indicated that the workshop had actually changed their views on Article 2. People indicated that it made them more aware of the ambiguity of the language of the Article, its relevance for driving the negotiations and communicating climate change to the general public, the inherent difficulties of valuation and aggregation, and the limited value of quantitative approaches (cost-benefit analysis) for policy evaluation.

Overall, many felt that the workshop was a good starting point and some indicated that they had gained ideas on how to bring the debate forward. At the same time, it was also clear that much more elaboration and discussion would be needed. Notwithstanding differences in views, it was felt that the group was still rather homogeneous. It was realised that the (global) dialogue would become much more difficult when other relevant stakeholders and developing countries would be involved, and if real choices (e.g. on indicators to be selected /prioritised and (un)acceptable indicator values) would have to be made.

The satisfaction of the participants about the workshop was reflected in the enthusiasm for participation in a global dialogue. All respondents indicated their interest to getting involved in the global dialogue.

4.2 Recommendations for the global dialogue

From the plenary evaluation and the questionnaires a number of recommendations for the global dialogue can be derived.

- Go ahead with the HOT dialogue. It was generally recommended to continue the HOT dialogue as it was viewed as very important and useful in supporting thinking about post-Kyoto policies.
- Diversify the group of participants. To make the dialogue more valuable and relevant the stakeholder participation should be widened: involve other ministries (like economic affairs and transport), business, local governments and indigenous groups.
- Keep away from the negotiations. Some stressed the importance of keeping the process far away from the formal negotiation process to preserve the constructive atmosphere. A suggestion was made to frame the global dialogue more in the context of sustainable development to avoid deadlocks due to debate between Annex I and non-Annex I on future commitments.
- Enhance the interaction with science. A continued involvement of scientist was highly recommended. Some suggested a stronger interaction with scientists, possibly by involving modelling teams to support the dialogue with analysis of policy options and by making the interaction with the science iterative. Other suggestions were to have more systematic scientific input; provide more comprehensive introductions to align participants' minds; and produce background papers for specific topics and clearer inputs for policy makers.
- Provide more information for defining acceptable levels. Next time, more information should be provided to help defining acceptable levels for indicators. The information provided should cover a broader range of effects, provide more specific information about risks to differentiate regions, groups and systems, and include alternative scientific perspectives (e.g. on economics).
- Elaborate on the workshop results. It was suggested to further elaborate on the workshop's outcomes related to the selection of indicators.
- Provide more clarity and structure. Given the complexity of the issue it was suggested to provide more clarity about envisaged outcomes and tasks, have more structured/focussed discussions and provide more intensive moderation.
- Take more time. There should be more time for discussion and the elaboration of ideas.
- Smaller breakout groups. Breakout groups are a good idea but keep them small.
- Create room for stakeholder's input. It was suggested to allow for stakeholders to provide their input to the debate, such as stakeholders from indigenous communities or industry.

Make a roadmap. It was suggested to work out a road map for how the dialogue would feed in to the negotiation process.

Appendix I. List of participants

1.	Mr. Jesper GUNDERMANN	DK
2.	Ms. Henriette BERSEE	NL
3.	Mr. Andy REISINGER	NZ
4.	Ms. Rie WATANABE	JP
5.	Ms. Jennifer MORGAN	DE
6.	Mr. Norichika KANIE	JP
7.	Mr. Howard BAMSEY	AUS
8.	Mr. Maciej SADOWSKI	POL
9.	Mr. John DREXHAGE	CAN
10.	Mr Stefan SINGER	BE
11.	Ms. Olga SPERANSKAYA	RUS
12.	Mr. Matt JONES	CAN
13.	Ms. Jan CORFEE-MORLOT	FA
14.	Mr. Bill HARE	DE
15.	Mr. Alex HAXELTINE	UK
16.	Mr. Michael OPPENHEIMER	USA
17.	Mr. Jonathan BARNETT	NZ
18.	Mr. Rik LEEMANS	NL
19.	Mr. David WARRILOW	UK
20.	Mr. Robert MENDELSOHN	USA
21.	Mr. Enno HARDERS	DE
22.	Mr. Paul CURNOW	AUS
23.	Mr. Donald GOLDBERG	US
24.	Mr. Rolf SARTORIUS	DE
25.	Mr. Andre KRANJC	Slov
26.	Ms. Jackie JONES	UK
27.	Mr. Per ROSENQVIST	SE
28.	Mr. José ROMERO	SW

Appendix II. Workshop Programme

Monday 2nd June

16.30 – 17.00 Reception
17.00 – 17.15 Welcome (Dr. Joyeeta Gupta, IVM)
17.15 – 17.30 Introduction to the HOT project / workshop (Dr. Bert Metz, RIVM)
Part 1. What do we mean with dangerous interference?
17.30 – 18.00 Results from the HOT survey on interpreting Article 2 (Mr. Marcel Berk, RIVM)
Refreshments
18.15 – 20.00 Stakeholders views on interpreting Article 2
(10 min per selected attendant) + Discussion
Workshop Dinner

Tuesday 3rd June

Part 2. *What can Science say about defining "dangerous interference"?*
09.00 – 09.10 Introduction to today's agenda (Dr. J Gupta)
09.10 – 10.15 Presentation of scientific insights regarding the implications of interfering with the climate system
- General introduction (Dr. Alex Haxeltine, The Tyndall Centre)
- Additional contributions from other scientists

Discussion
Coffee break
Part 3. *How to define "dangerous" climate change related impacts?*
10.30 – 12.00 Discussion in 2 breakout on elaborating different dimensions of "dangerous" climate change related impacts:

- What are the relevant indicators for defining 'dangerous interference' from the impact perspective? What is the appropriate level of scale?
- What level of adaptation is feasible and acceptable?
- What are suitable threshold indicators and critical event levels for defining unacceptable climate change related impacts?
- What level of certainty do we want about the likelihood of avoiding these critical incidences?
- What are our critical information needs?

12.00 – 13.00 Plenary discussion on the results of the 2 breakout groups.
Lunch break
Part 4. *How to balance risks and interests?*
14.00 – 15.00 Discussing the broader scope: approaching "dangerous interference" from an integrated perspective including also costs, implementation and equity issues.

Part 5. How to set up a global dialogue on Article 2?

15.00 – 15.15 Ideas about the design of the second phase of HOT (Dr. J. Gupta)

15.15 – 16.00 Discussion

16.00 – 16.30 Wrap up and Evaluation

Appendix III. Questionnaire Helping operationalise Article 2 of the UNFCCC

Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC):

"The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

1. Do you think that the three conditions in Article 2 ("allow ecosystems to adapt naturally", "ensure that food production is not threatened" and "enable economic development to proceed in a sustainable manner") can be used to define the level at which GHG concentrations will become "dangerous"? Are there other conditions that should be taken into account? Is anything (else) missing or inadequate in this Article?
2. When would you say that the conditions in Article 2 are no longer met?
3. At what scale should these conditions be assessed? (e.g. Should all ecosystems be able to adapt naturally? Should food production everywhere be safe? Should all forms of economic activity be able to develop sustainably?)
4. Are the three conditions equally important? How would you prioritise them?
5. What (scientific) information would be needed (most) to be able to better evaluate the implications of Article 2?
6. What consequences / outcomes of climate change policies would you consider to be unacceptable? What conditions should climate change policies meet?
7. Stabilizing GHG concentrations at any level will involve costs of reducing emissions and also costs of adapting to climate change impacts. How should these costs be distributed?
8. What controversies do you expect will arise in discussing Article 2?
9. What other policy issues should be considered in interpreting Article 2?

- international trade (WTO)
- national security
- international security
- international power relations
- religious or ideological principles
- cultural differences
- others (please specify):

10. As part of the first phase of the HOT project regional workshops will be convened to discuss the agenda and proper process for a global dialogue on Art. 2. What do you consider the most important issues that should be discussed at such a scoping workshop?

11. Would you be interested in getting involved in the HOT global dialogue?

Yes □ No □

12. Can you identify other people who you feel would be able to provide relevant input for this dialogue? If so, could you please provide contact information that will allow researchers to contact them?

1)

2)

3)